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The bess beetles (Coleoptera, Passalidae) of three subregions of the Department of Sucre, Caribbean region of Colombia

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Abstract
We provide species lists and geographical occurrence records of the beetle family Passalidae for three subregions of the department of Sucre, northern Colombia. The sampling localities are lowland environments with typical tropical dry forest vegetation. We selected 15 sampling sites and examined decomposing trunks. We record seven species, four genera, and two tribes of Passalidae. The most abundant species were *Passalus punctiger* Lepeletier & Serville, 1825, *P. interstitialis* Eschscholtz, 1829, and *P. interruptus* (Linnaeus, 1758). We also provide new records for *Passalus punctatostriatus* Percheron, 1835, *Paxillus leachi* MacLeay, 1819, and *Popilius marginatus* (Percheron, 1835) in the department of Sucre. *Veturius aspina* Kuwert, 1898 was present only in the localities with well-preserved forests. Finally, the species number recorded in this study is low compared to other inventories in Neotropical regions.

Keywords
Distribution, new records, Passalinae, Scarabaeoidea, taxonomy, tropical dry forest, species richness.

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Introduction

Species inventories are important data sources for analyses of diversity patterns. Documenting species distributions and abundances is important not only for comparative analyses, but also for quantifying population trends in response to habitat modification (Lawton et al. 1998). Many of the current conservation initiatives stem from biodiversity monitoring efforts and as a result of species inventories, data on species occurrences and geographical distributions can be provided for different localities. In the tropics, some groups are well monitored with extensive checklists e.g. Amphibian, birds, mammals (Savage and Bolaños 2009; Navarro-Sigüenza et al. 2014; Kraker-Castañeda et al. 2016; Avendaño et al. 2017), while less data exist for insects, despite their great diversity.

Saproxylic beetles are easily inventoried and their diversity has been well documented, especially for conservation purposes (Grove and Stork 1999; Grove 2002). Beetles belonging to the families Scarabaeidae, Passalidae, and Cerambycidae have been considered useful biological indicators of habitat modification due to their high vulnerability to habitat degradation (Skotland et al. 2012; Ramírez-Hernández et al. 2019). Passalidae are among those saproxylic beetles that live and feed in decomposing wood, accelerating the physical degradation of wood and thus the recycling of organic matter (Castillo and

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Reyes-Castillo 2003). This family has hygrophilic preferences and are mainly distributed in tropical and temperate-humid regions at altitudes ranging from sea level to 3000 m a.s.l. (Reyes-Castillo 2002).

The passalids are among the best-studied coleopteran groups in Colombia. During the last 30 years, more than 40 studies have contributed to the knowledge of their diversity (Jiménez-Ferbans et al. 2018a), and their distribution in Colombia is reasonably well understood. However, there are still localities left to explore, and more detailed ecological studies are needed in those areas already explored. For the Caribbean region of Colombia, the knowledge of the Passalidae is based on the inventories made by Jiménez-Ferbans and Amat-García (2009, 2010) and Jiménez-Ferbans et al. (2010). They have systematically explored the richness of Passalidae in northern Colombia, and their work has contributed to the understanding of taxonomical, ecological, and biogeographical aspects of the group. The department of Sucre remains comparatively unexplored in terms of Passalidae diversity, with only a few records available. Sucre is a department of the Caribbean region of Colombia, characterized by a mosaic of landscape types ranging from well-preserved tropical dry forests, savannas, coastal areas, and tropical rainforests to more heavily human-impacted agricultural areas. In this work, we contribute to the knowledge of the bess beetles fauna (Coleoptera, Passalidae) living in dead tree trunks of dry tropical forests and savannas in three subregions of the department of Sucre, Colombia.

Methods

Study area. The field sampling was carried out in 15 localities within three subregions or physiographic provinces of the department of Sucre according to the classification proposed by Aguilera (2005) (Fig. 1). The subregions are described as follow:

1. Golfo del Morrosquillo is an area of 1,886 km² located on the coastline at the north of the department. It consists of the municipalities Coveñas, Palmitos, Tolú, Tolú viejo and San Onofre. Mangroves and coastal lagoons dominate the landscape, with smaller fractions of anthropic savanna and mountains. Annual rainfall reaches an average of 1,050 mm, the monthly average temperature is 27.4 °C, and the average relative humidity is 77%.

2. Montes de María is an area of 1,104 km² located in the north-eastern part of the department. It consists of the municipalities Sincelejo, Ovejas, Chalán, Morroa, and Colosó. Dry tropical forest and mountains dominate the landscape. Annual rainfall reaches between 1,000 and 1,200 mm, the monthly average temperature is 26.8 °C, and the relative humidity is 77.3%.

3. Sabanas is an area of 2,101 km² located in the central part of the department. It consists of the municipalities Sincé, El Roble, San Pedro, Sampués, Los Palmitos, Galeras, Buenavista, Corozal, and San Juan de Betulia, with an area formed by mountainous undulations that range from 70 to 185 m a.s.l. The climate is characteristic

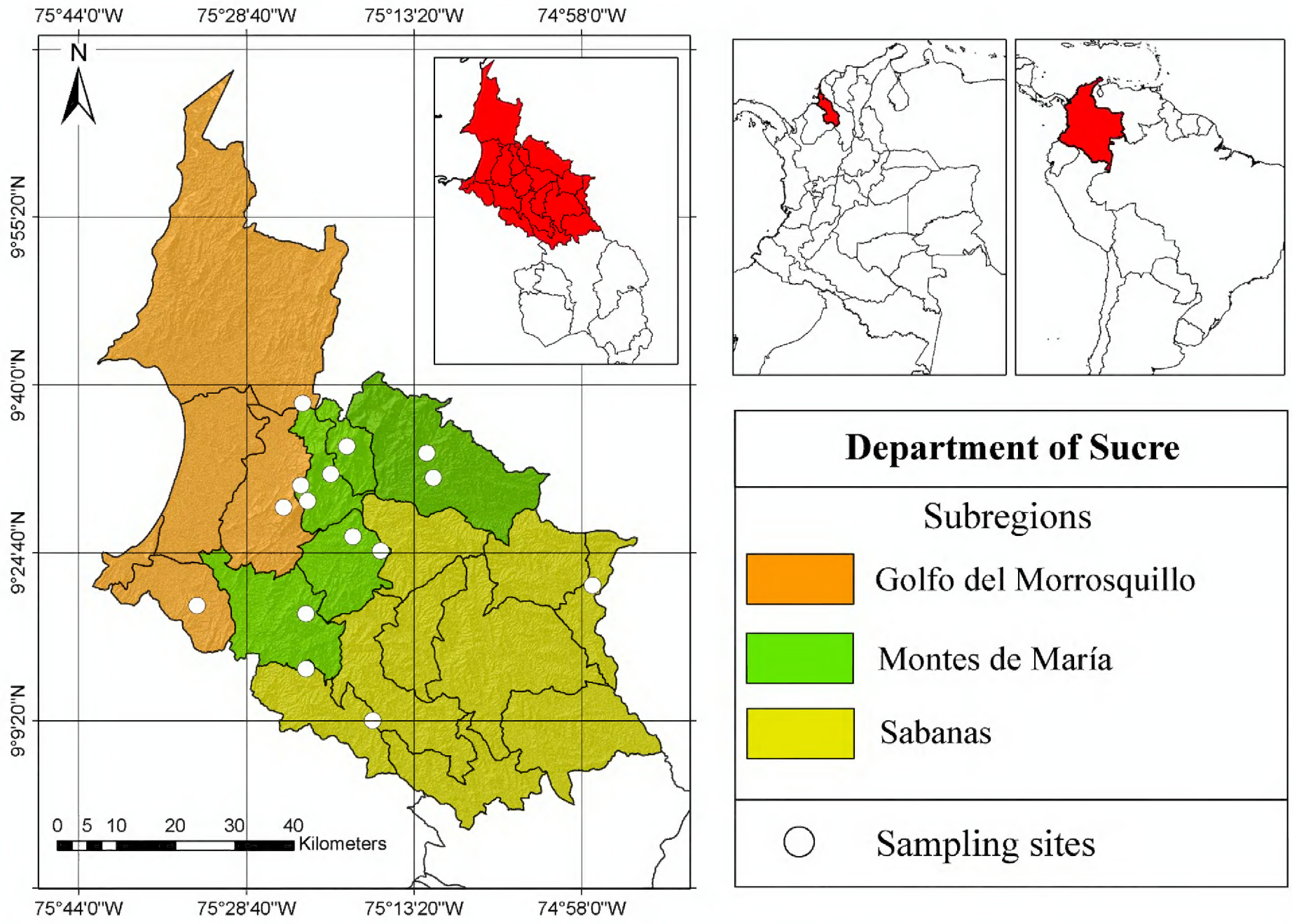

Figure 1. The geographical location of the 15 sampling localities in the department of Sucre, northern Colombia.

of tropical dry forest areas, and there are few remnants of secondary vegetation, stubble, and extensive grassland areas. Annual rainfall reaches between 990 and 1,275 mm, the monthly average temperature is 27.2 °C, and the relative humidity is 80%.

Data collection, species identification, and analysis. The field sampling was carried out between 2014 and 2017. For each sampling locality, fallen dead tree trunks were randomly chosen along trails inside or at the edges of forests, sliced with a hand ax, and sampled for active galleries of passalids. All specimens encountered were collected and stored in 96% ethanol, with their respective collection data. The collected material was transported to the Universidad de Sucre and processed in the laboratory of biological conservation. Passalids were identified with the aid of the identification keys proposed by Schuster and Cano (2005) and Jiménez-Ferbans and Amat-García (2010). The individuals were deposited in the Zoological Collection of the Universidad de Sucre (MZUSU), Colombia. Photographs were taken using a Nikon D3200 camera equipped with an 18–55 mm macro lens. Species occurrences were georeferenced by locality and the distribution maps were prepared in ArcGIS v. 10.2.1.

Results

A total of 408 passalid specimens belonging to seven species, four genera, and two tribes were collected. The most common passalid species was *Passalus punctiger* Lepeletier & Serville, 1825, and the most species-rich locality was the subregion Montes de María (Fig. 2).

Tribe Passalini

***Passalus* (*Passalus*) *interruptus* (Linnaeus, 1758)**
Figures 3A, 4A

Material examined. COLOMBIA • [20 exs, sex undetermined]; Sucre Department, Corozal Municipality, Las llanadas; 09°9′18.97″N, 075°17′6.48″W; 121 m a.s.l.; 23 Dec. 2016; Taboada-Verona leg; MZUSU E03396-15. • [1♀1♂]; Sucre Department, San Onofre Municipality, Aguacate, 09°38′20.3″N, 075°23′31.6″W; 59 m a.s.l.; 07 Apr. 2016; Taboada-Verona leg; MZUSU E03027-28. • [2♀]; Sucre Department, San Antonio de Palmito Municipality, Cerro el Cristo; 09°19′50.89″N, 075°33′10.09″W; 43 m a.s.l.; 29 Sep. 2014; Taboada-Verona leg; MZUSU E02165-E0218. • [1♀]; Sucre Department, Colosó Municipality, Parque Aventura Roca Madre; 09°30′50.18″N, 075°23′40.254″W; 330 m a.s.l.; 03 Feb. 2015; Taboada-Verona leg; MZUSU E02200. • [14 exs, sex undetermined]; Sucre Department, Tolú Viejo Municipality, La Gaviota; 09°28′47.7″N, 075°25′14.6″W; 145 m a.s.l.; 13 Dec. 2017; Taboada-Verona leg; MZUSU E03311-24. • [1 ex, sex undetermined]; Sucre Department, Sincelejo Municipality, Campus Unisucre sede Puerta Roja; 09°19′3.87″N, 075°23′11.50″W; 181 m a.s.l.; 19 Mar. 2016; Taboada-Verona col, MZUSU E02675. • [1♂]; Sucre Department, Colosó Municipality, Paraíso; 09°29′23.8″N, 075°23′04.1″W; 147 m a.s.l.; 11 Mar. 2016; Taboada-Verona leg; MZUSU E03144. • [1♂1♀]; Sucre Department, Morroa Municipality, Finca el Socorro; 09°24′50.89″N, 075°16′22.6″W; 192 m a.s.l.; 01 Mar. 2016; Taboada-Verona col; MZUSU E03060-61.

Identification. Characterized by its large size (48.84–50.70 mm), clypeus hidden below frons, dorsally not visible, free central carina, rounded secondary tubercle, the apex of lacinia bidentate. Prosternal process rhomboidal, mesosternal scar marked with some setae in anterior part of mesosternum; last abdominal sternite incomplete.

Geographical distribution. Panama to Argentina and Trinidad and Tobago (Reyes-Castillo 1973; Jiménez-Ferbans et al. 2013; Jiménez-Ferbans et al. 2015; Bevilaqua and Fonseca 2018). In Colombia: Amazonas, Caquetá, Casanare, Chocó, Córdoba, Cundinamarca, Huila, Valle del Cauca, Magdalena, Meta, and Sucre (Reyes-Castillo and Amat-García 2003; Amat-García et al. 2004; Amat-García and Reyes-Castillo 2007; Jiménez-Ferbans and Amat-García 2009; Neita-Moreno 2011; Salazar-Niño and Amat-García 2015; Taboada-Verona et al. 2019).

***Passalus* (*Passalus*) *interstitialis* Eschscholtz, 1829**
Figures 3B, 4B

Material examined. COLOMBIA • [17 exs, sex undetermined]; Sucre Department, Buenavista Municipality, Las Chichas, 09°21′40.84″N, 074°56′59.24″W; 101 m a.s.l.; 08 Apr. 2017; Taboada-Verona leg; MZUSU E03098-14. • [1♀]; Sucre Department, Colosó Municipality, Parque Aventura Roca Madre, 09°30′50.18″N, 075°23′40.254″W; 330 m a.s.l.; 03 Jan. 2015, Taboada-Verona leg; MZUSU E02201. • [9 exs, sex undetermined]; Sucre Department, Colosó Municipality, Parque Aventura Roca Madre, 09°30′50.18″N, 075°23′40.254″W; 330 m a.s.l.;04 Dec. 2017; Taboada-Verona leg; MZUSU E03204-12. • [1 ex, sex undetermined]; Sucre Department, Tolú Viejo Municipality, La Gaviota; 09°28′47.7″N, 075°25′14.6″W; 145 m a.s.l.; 13 Dec. 2017; Taboada-Verona leg; MZUSU E03310. • [4♀3♂]; Sucre Department,

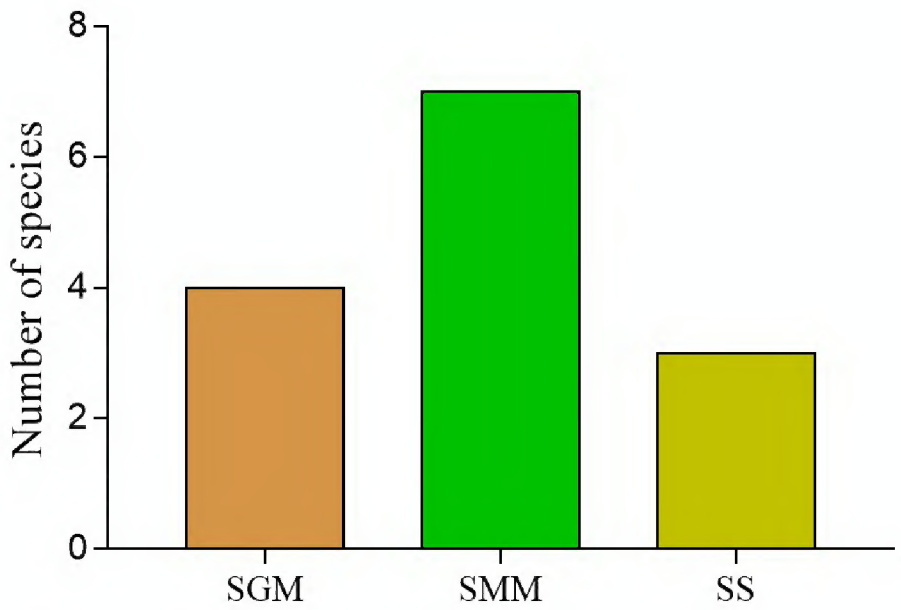

Figure 2. Number of passalid species recorded in each subregion. SGM = Subregion Golfo de Morrosquillo; SMM = subregion Montes de María; SS = Subregion Sabanas.

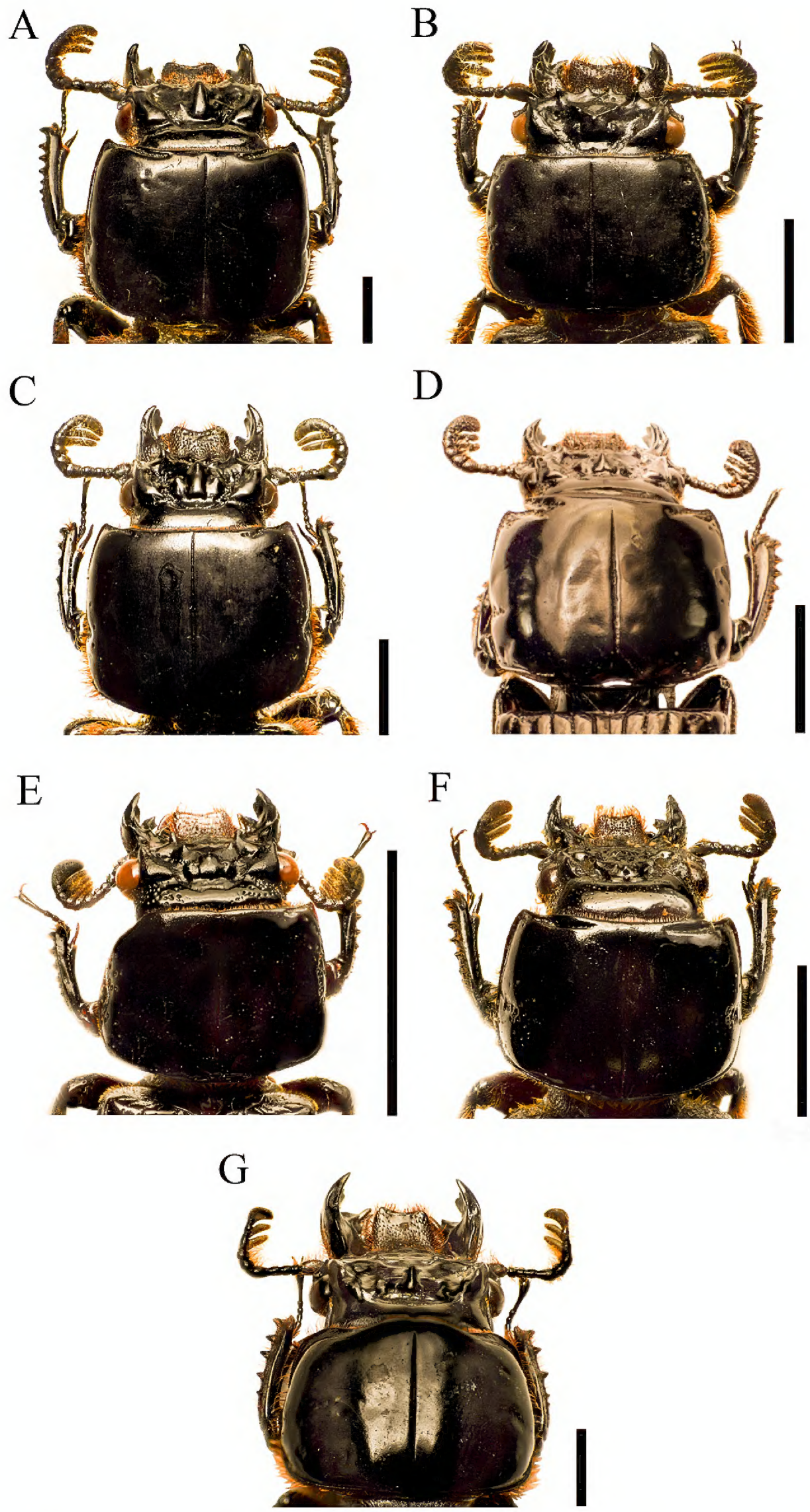

Figure 3. Detail of the head in dorsal view of passalid species. **A.** *Passalus interruptus*. **B.** *Passalus interstitialis*. **C.** *Passalus punctiger*. **D.** *Passalus punctatostriatus*. **E.** *Paxillus leachi*. **F.** *Popilius marginatus*. **G.** *Veturius aspina*. Scale bars: 0.5 cm.

Sampués Municipality, Mateo Pérez; 09°14′2.0″N, 075°23′12.4″W; 148 m a.s.l.; 06 Sep. 2016; Taboada-Verona leg; MZUSU E02149-55. • [1♀]; Sucre Department, San Antonio de Palmito Municipality, Cerro el Cristo; 09°19′50.89″N, 075°33′10.09″W; 43 m a.s.l.; 29 Sep. 2014; Taboada-Verona leg; MZUSU E02156. • [4♀1♂]; Sucre Department, San Onofre Municipality, Aguacate; 09°38′20.3″N, 075°23′31.6″W; 59 m a.s.l.; 07 Apr. 2016; Taboada-Verona leg; MZUSU E03038-42. • [10 exs, sex undetermined]; Sucre Department, Morroa Municipality, Finca el Socorro; 09°24′50.89″N, 075°16′22.6″W; 192 m a.s.l.; 06 Jun. 2015; Taboada-Verona leg; MZUSU E03050-59. • [4 exs, sex undetermined]; Sucre Department, Colosó Municipality, Paraíso; 09°29′23.8″N, 075°23′04.1″W; 147 m a.s.l.; 11 Mar. 2016; Taboada-Verona leg; MZUSU E03140-43.

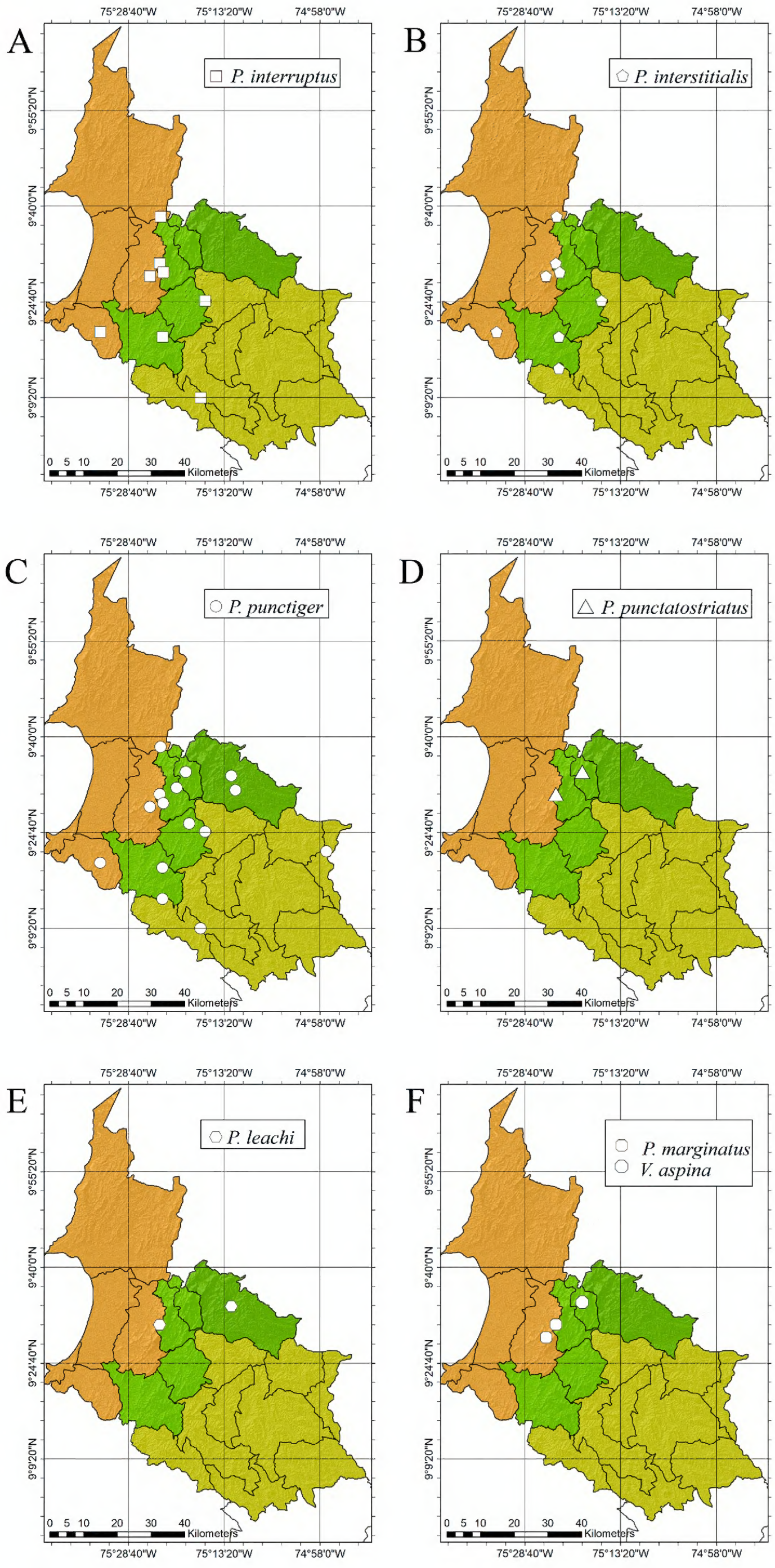

Figure 4. Distribution of passalid species in three subregions of the department of Sucre, Colombia.

• [1 ex, sex undetermined]; Sucre Department, Sincelejo Municipality, Campus Unisucre sede Puerta Roja; 09°19′3.87″N, 075°23′11.50″W; 181 m a.s.l.; 10 Nov. 2016; Taboada-Verona leg; MZUSU E03145. • [1 ex, sex undetermined]; Sucre Department, Sincelejo Municipality, Campus Unisucre sede Puerta Roja; 09°19′3.87″N, 075°23′11.50″W; 181 m a.s.l.; 07 May. 2016; Taboada-Verona leg; MZUSU E02667.

Identification. *Passalus interstitialis* is distinguished by its moderate size (26.35–29.44 mm), clypeus hidden below frons, dorsally not visible; medio-frontal tubercles small, sharp secondary tubercle and closer to the outer tubercle. Dorsoventrally flat body, prosternal process rhomboidal. Mesosternum glabrous with scars marked.

Geographical distribution. Mexico to Argentina, including Cuba, Granada, and Trinidad and Tobago (Arrow 1907; Hincks and Dibb 1935; Reyes-Castillo 1973; Peck et al. 2002; Jiménez-Ferbans et al. 2013; Jiménez-Ferbans et al. 2015; Bevilaqua and Fonseca 2018). In Colombia: Amazonas, Antioquia, Bolívar, Caldas, Caquetá, Cauca, Cesar, Chocó, Córdoba, Cundinamarca, La Guajira, Magdalena, Meta, Nariño, Quindío, Sucre, Tolima, Valle del Cauca, and Vichada (Pardo-Locarno et al. 2000; Reyes-Castillo and Amat-García 2003; Amat-García et al. 2004; Amat-García and Reyes-Castillo 2007; Jiménez-Ferbans and Amat-García 2009; Neita-Moreno 2011; Salazar-Niño and Amat-García 2015; Taboada-Verona et al. 2019).

Passalus (*Passalus*) *punctiger* Lepeletier & Serville, 1825

Figures 3C, 4C

Material examined. COLOMBIA• [5 exs, sex undetermined]; Sucre Department, Buenavista Municipality, Las Chichas; 09°21′40.84″N, 074°56′59.24″W; 101 m a.s.l.; 08 Apr. 2017; Taboada-Verona leg; MZUSU E03115-19. • [6 exs, sex undetermined]; Sucre Department, Corozal Municipality, Las llanadas; 09°9′18.97″N, 075°17′6.48″W, m a.s.l., 23 Dec. 2016, Taboada-Verona col, MZUSU E03416-21. • [39 exs, sex undetermined]; Sucre Department, Chalán Municipality, La División; 09°34′23.7″N, 075°19′27.6″W, 632 m a.s.l.; 08 Nov. 2017; Taboada-Verona leg; MZUSU E03260-98. • [3♂9♀]; Sucre Department, Colosó Municipality, Parque Aventura Roca Madre; 09°30′50.18″N, 075°23′40.254″W; 330 m a.s.l.; 03 Jun. 2015; Taboada-Verona leg; MZUSU E02188-99. • [3 exs, sex undetermined]; Sucre Department, Colosó Municipality, Parque Aventura Roca Madre; 09°30′50.18″N, 075°23′40.254″W; 330 m a.s.l.; 04 Dec. 2017; Taboada-Verona leg; MZUSU E03199-01. • [9 exs, sex undetermined]; Sucre Department, San Onofre Municipality, Aguacate; 09°38′23.4″N, 075°23′31.6″W; 59 m a.s.l.; 07 Apr. 2016; Taboada-Verona leg; MZUSU 3029-37. • [7 exs, sex undetermined]; Sucre Department, Morroa Municipality, Finca el Socorro; 09°24′50.89″N, 075°16′22.6″W; 192 m a.s.l.; 06 Jun. 2015; Taboada-Verona leg; MZUSU E03043-49. • [6 exs, sex undetermined]; Sucre Department, Morroa Municipality, Finca el Socorro; 09°24′50.89″N, 075°16′22.6″W; 192 m a.s.l.; 01 Mar. 2016; Taboada-Verona leg; MZUSU E03062-67. • [4 exs, sex undetermined]; Sucre Department, Ovejas Municipality, El Principio; 09°33′45.9″N, 075°12′10.6″W; 210 m a.s.l.; 07 Mar. 2016; Taboada-Verona leg; MZUSU E03068-71. • [2 exs, sex undetermined]; Sucre Department, Ovejas Municipality, La Peña; 09°31′29.8″N, 075°11′32.7″W; 206 m a.s.l.; 08 Mar. 2016; Taboada-Verona leg; MZUSU E03422-23. • [26 exs, sex undetermined]; Sucre Department, Morroa Municipality, Finca el Oriente; 09°26′7.5″N, 075°18′55.7″W; 155 m a.s.l.; 09 Mar. 2016; Taboada-Verona leg; MZUSU E03072-97. • [7 exs, sex undetermined]; Sucre Department, Colosó Municipality, Paraíso; 09°29′23.8″N, 075°23′04.1″W; 147 m a.s.l.; 11 Mar. 2016; Taboada-Verona leg; MZUSU E03133-39. • [2 exs, sex undetermined]; Sucre Department, Colosó Municipality, Estación Primates; 09°31′52.1″N, 075°20′57.1″W; 251 m a.s.l.; 10 Jun. 2016; Taboada-Verona leg; MZUSU 03131-32. • [11 exs, sex undetermined]; Sucre Department,Tolú Viejo Municipality, La Gaviota; 09°28′47.7″N, 075°25′14.6″W; 145 m a.s.l.; 13 Jun. 2016; Taboada-Verona leg; MZUSU E03120-30. • [7 exs, sex undetermined]; Sucre Department,Tolú Viejo Municipality, La Gaviota; 09°28′47.7″N, 075°25′14.6″W; 145 m a.s.l.;13 Dec. 2017; Taboada-Verona leg; MZUSU E03303-09. • [7 exs, sex undetermined]; Sucre Department, Sincelejo Municipality, Campus Unisucre sede Puerta Roja; 09°19′3.87″N, 075°23′11.50″W; 181 m a.s.l.; 19 Mar. 2016; Taboada-Verona leg; MZUSU E02668-74. • [8♀11♂]; Sucre Department, Sampués Municipality, Mateo Pérez; 09°14′2.0″N, 075°23′12.4″W; 148 m a.s.l.; 06 Sep. 2016; Taboada-Verona leg; MZUSU E02129-48. • [5♀3♂]; Sucre Department, San Antonio de Palmito Municipality, Cerro el Cristo; 09°19′50.89″N, 075°33′10.09″W; 43 m a.s.l.; 29 Sep. 2014; Taboada-Verona leg; MZUSU E02157-64. • [15 exs]; Sucre Department, San Antonio de Palmito Municipality, Cerro el Cristo; 09°19′50.89″N, 075°33′10.09″W; 43 m a.s.l.; 29 Sep. 2014; Taboada-Verona leg; MZUSU E02166-80. • [2♀]; Sucre Department, San Antonio de Palmito Municipality, Cerro el Cristo; 09°19′50.89″N, 075°33′10.09″W; 43 m a.s.l.; 29 Sep. 2014; Taboada-Verona leg; MZUSU E02182-83.

Identification. This species presents clypeus hidden below frons, dorsally not visible, medio-frontal tubercles developed, with larger interior tubercles. Prosternal process rhomboidal, glabrous mesosternal scar, and last abdominal sternite complete. Large (29.85–42.50 mm).

Geographical distribution. Mexico to Argentina, including Granada, Jamaica, Saint Vincent and the Grenadines, and Trinidad and Tobago (Reyes-Castillo 1973; Chalumeau 1978; Schuster 1978; Peck et al. 2002; Peck 2010; Jiménez-Ferbans et al. 2013; Jiménez-Ferbans et al. 2015; Bevilaqua and Fonseca 2018). In Colombia: Amazonas, Antioquia, Atlántico, Bolívar, Boyacá, Caquetá,

Casanare, Cauca, Cesar, Chocó, Córdoba, Cundinamarca, La Guajira, Huila, Magdalena, Meta, Nariño, Quindío, Risaralda, Sucre, Tolima, Valle del Cauca, and Vichada (Pardo-Locarno et al. 2000; Reyes-Castillo and Amat-García 2003; Amat-García et al. 2004; Amat-García and Reyes-Castillo 2007; Jiménez-Ferbans and Amat-García 2009; Neita-Moreno 2011; Salazar-Niño and Amat-García 2015; Taboada-Verona et al. 2019).

***Passalus* (*Pertinax*) *punctatostriatus* Percheron, 1835**
Figures 3D, 4D

Material examined, new record. COLOMBIA • [45 exs, sex undetermined]; Sucre Department, Chalán Municipality, La División; 09°34′23.7″N, 075°19′27.6″W; 632 m a.s.l.; 19 Nov. 2017; Taboada-Verona leg; MZUSU E03213. • [2 exs, sex undetermined]; Sucre Department, Colosó Municipality, Parque Aventura Roca Madre; 09°30′50.18″N, 075°23′40.254″W; 330 m a.s.l.; 04 Nov. 2017; Taboada-Verona leg; MZUSU E03202-03.

Identification. Clypeus hidden below frons, dorsally not visible, inferolateral pubescence of pronotum very scarce. Prosternal process rhomboidal, metasternum and humeri glabrous, middle and posterior tibiae armed with spines. Medium-sized (23.53–25.80 mm).

Geographical distribution. Mesoamerica to northern South America (Jiménez-Ferbans et al. 2018b). In Colombia: Amazonas, Magdalena, and La Guajira (Amat-García et al. 2004; Amat-García and Reyes-Castillo 2007; Jiménez-Ferbans and Amat-García 2009).

***Paxillus leachi* MacLeay, 1819**
Figures 3E, 4E

Material examined, new record. COLOMBIA • [1♀]; Sucre Department, Colosó Municipality, Parque Aventura Roca Madre; 09°30′50.18″N, 075°23′40.254″W; 330 m a.s.l.; 03 Jun. 2015; Taboada-Verona leg; MZUSU E02187. • [39 exs, sex undetermined]; Sucre Department, Colosó Municipality, Parque Aventura Roca Madre; 09°30′50.18″N, 075°23′40.254″W; 330 m a.s.l.; 04 Dec. 2017; Taboada-Verona col, MZUSU E03160-98. • [1 ex, sex undetermined]; Sucre Department, Ovejas Municipality, El principio; 09°33′45.9″N, 075°12′10.6″W; 210 m a.s.l.; 07 Mar. 2016; Taboada-Verona leg; MZUSU E03325.

Identification. Depressed body; dorsal tooth widened in its base; long external tubercles, in view dorsal reach or exceed front edge; tenth antennal segment slender toward the distal part; lacinia unidentate. Prosternal process pentagonal, smooth metasternum disc. Small (14.77–18.50 mm).

Geographical distribution. Mexico to Argentina (Reyes-Castillo 1973; Boucher 1986; Reyes-Castillo and Fonseca 1992; Jiménez-Ferbans et al. 2013; Jiménez-Ferbans and Reyes-Castillo 2015; Bevilaqua and Fonseca 2018). In Colombia: Amazonas, Antioquia, Boyacá, Caquetá, Córdoba, Chocó, Magdalena, Meta, Putumayo, Risaralda, Santander, and Valle del Cauca (Pardo-Locarno et al. 2000; Reyes-Castillo and Amat-García 2003; Amat-García et al. 2004; Amat-García and Reyes-Castillo 2007; Jiménez-Ferbans and Amat-García 2009; Neita-Moreno 2011; Salazar-Niño and Amat-García 2015).

Tribe Proculini

***Popilius marginatus* (Percheron, 1835)**
Figures 3F, 4F

Material examined, new record. COLOMBIA • [2♀ 1♂]; Sucre Department, Colosó Municipality, Parque Aventura Roca Madre; 09°30′50.18″N, 075°23′40.254″W, 330 m a.s.l.; 03 Jun. 2015; Taboada-Verona leg; MZUSU E02184-86. • [14 exs, sex undetermined]; Sucre Department, Colosó Municipality, Parque Aventura Roca Madre; 09°30′50.18″N, 075°23′40.254″W; 330 m a.s.l.; 04 Dec. 2017; Taboada-Verona leg; MZUSU E03146-59. • [4 exs, sex undetermined]; Sucre Department, Tolú Viejo Municipality, La Gaviota; 09°28′47.7″N, 075°25′14.6″W; 145 m a.s.l.; 13 Dec. 2017; Taboada-Verona leg; MZUSU E03299-02.

Identification. Clypeus exposed dorsally, horn of the medium frontal structure with the apex at the level of the lateral tubercles. Humeri with little pubescence at the base, epipleura and glabrous metasternum without points. Medium-sized (22.53–25.82 mm).

Geographical distribution. Argentina, Bolivia, Brazil, Colombia, French Guiana, Peru, and Suriname (Gillogly 2005; Jiménez-Ferbans et al. 2013; Bevilaqua and Fonseca 2018). In Colombia: Boyacá, Cesar, Magdalena, Meta, Nariño, Santander, and Valle del Cauca (Amat-García et al. 2004; Amat-García and Reyes-Castillo 2007; Jiménez-Ferbans and Amat-García 2009; Salazar-Niño and Amat-García 2015).

***Veturius* (*Veturius*) *aspina* Kuwert, 1898**
Figures 3G, 4F

Material examined. COLOMBIA • [1♀1♂]; Sucre Department, Chalán Municipality, La División, 09°34′23.7″ N, 075°19′27.6″W; 632 m a.s.l.; 08 Nov. 2017; Taboada-Verona leg; MZUSU: E03258-59.

Identification. Anterior edge of labrum concave, clypeus exposed dorsally; frontoclypeal suture absent. Large pronotum, equivalent to half the length of elytra, prosternal process rhomboidal, glabrous metasternum without points and last abdominal sternite complete, rounded elytra. Large (>40 mm).

Geographical distribution. Honduras to Ecuador (Salazar-Niño and Boucher, 2018). In Colombia: Antioquia, Boyacá, Caldas, Cauca, Cesar, Córdoba, Cundinamarca, Chocó, Nariño, Risaralda, Santander, Sucre, Tolima, and Valle del Cauca (Boucher 2006; Salazar-Niño and Boucher 2018).

Discussion

Based on extensive field sampling over several years, we suggest that the species diversity of Passalidae beetles

in Sucre is comparatively low. The most frequent genus in the region is *Passalus* Fabricius, 1792, represented by four species. This genus is abundant and widely recorded in many localities across Colombia with geographical distribution from sea level to 3800 m a.s.l. (Amat-García et al. 2004; Jiménez-Ferbans et al. 2018a). Likewise, this genus comprises more than 50% of the known passalid species in Colombia (Jiménez-Ferbans et al. 2018a). The most frequent species was *P. punctiger*, which is a widespread species occurring under diverse conditions of humidity and temperature. Some studies have suggested that this species can take advantage of different substrates to colonize, adapt and subsequently expand their niches (Reyes-Castillo and Castillo 1992; Pardo-Locarno et al. 2000). Furthermore, *P. punctiger* is considered a highly competitive species sharing its diet with other beetle species (Pardo-Locarno et al. 2000). Another abundant species was *P. interstitialis*, with a strong affinity to the subcortical substrate. Despite its wide distribution, the strict preference for the subcortical substrate reduces its chances of colonization and use of decomposing logs (Castillo and Reyes-Castillo 1997; Pardo-Locarno et al. 2000). *Passalus interruptus* was also frequently collected, confirming its abundance and wide distribution in the lowlands of Colombia (Reyes-Castillo and Amat-García 2003; Jiménez- Ferbans and Amat-García 2009).

Other species were more narrowly distributed. For example, *P. punctatostriatus* was recorded only in mountainous areas. According to Jiménez-Ferbans et al. (2012), Colombian species of the subgenus *Pertinax* tend to dominate middle altitudes. Regarding *P. leachi*, the specimens collected in this study were from well-preserved forests. Its presence is associated with regenerating forests (Reyes-Castillo and Amat-García 2003; Jiménez-Ferbans and Amat-García 2009), and its distribution extends through lowland forests (Jiménez-Ferbans and Reyes-Castillo 2015). Conversely, *V. aspina*, which was recorded in Montes de Maria, reaches 2000 m a.s.l. However, studies have suggested that the altitude and the life zone where this species occurs depend to a great extent on the ecological characteristics of each region, and *V. aspina* is better adapted to altitudes lower or close to 1000 m a.s.l. (Salazar-Niño and Boucher 2018), such as Montes de María. The low representation of *Veturius* species in the sampling area could relate to the fact that most species of this genus are restricted to higher altitudes (Boucher 2006). Finally, *P. marginatus* is not known from altitudes above 500 m a.s.l (Gillogly 2005). Although Jiménez-Ferbans and Amat-García (2009) recorded this species up to 1560 m a.s.l, thus extending its known altitudinal distribution range, in this study, *P. marginatus* was collected over 300 m a.s.l, consistent with Gillogly (2005).

Our results suggest that the subregions Montes de María and Golfo de Morrosquillo harbor greater species diversity than the Sabanas subregion. This finding can be interpreted in the light of the climatic and orographic conditions of each subregion. For instance, Montes de María and Golfo de Morrosquillo are both part of the Coraza mountain range, which encompass nearly 3,000 ha of primary forest (Galvan-Guevara et al. 2009). The presence of well-preserved forests may allow a stably supply of decaying trunks and branches. In contrast, the Sabanas subregion is heavily influenced by anthropogenic actions which have led to reduced tree cover and soil degradation (Aguilera 2005). Reduced plant cover results in increased evaporation driven by solar radiation, which could affect the abundances of insect populations, including beetles of the Passalidae family, due to their sensitivity to the drying of wood (Saunders et al. 1991; Kozuke et al. 2007).

The results also confirm lower species richness of passalids in tropical dry ecosystems compared to tropical rainforests (Schuster 1978; Pardo-Locarno et al. 2000; Jiménez-Ferbans and Amat-García 2009). Low substrate humidity is a potential restrictive factor driving passalid diversity by imposing ecological distribution limits (Pardo-Locarno et al. 2000). The hygrophilous affinity of this family is apparent from the marked increase in richness towards the most humid forest ecosystems (Castillo and Reyes-Castillo 2003). Similar patterns have also been found with regard to altitude, where passalids are more diverse at high altitudes (MacVean and Schuster 1981; Reyes-Castillo and Amat-García 2003).

The number of species recorded in this study is similar to that recorded from other departments of the Caribbean region of Colombia, sharing species with a wide geographical and altitudinal distribution. However, compared to other areas with higher humidity or mountainous systems in Colombia, such as the Andes, the Chocó biogeographic and the Amazon, the number of species of passalids recorded in Sucre is low. It is likely that the number of species can be increased substantially by exploring additional sampling locations, especially in the areas of Montes de María and Golfo del Morrosquillo, which represent the highest-altitude mountainous areas of the department. Furthermore, we did not explore the subregions San Jorge and Mojana, which are characterized by tropical rainforest. Finally, we highlight the importance of this species inventory because a large part of the department of Sucre is represented by tropical dry forest, an ecosystem that is highly threatened. Therefore, knowing the distribution of these bioindicator beetles and including the new records generated for the department would allow us to create more detailed and specific conservation strategies in the future.

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Authors' Contributions

CTV collected and identified. Both authors contributed to the preparation of the manuscript.

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